REMARKS

Claims 55-68 and 79 are pending in the application with new claim 79 added herein.

New claim 79 sets forth an oxidation protection method for metal-containing material during semiconductor processing that includes, among other features, forming a second metal-containing material on and in contact with a first metal-containing material consisting essentially of copper and annealing the first and second metal-containing materials at a temperature of greater than 400 to about 500 °C to form an intermetal material from some of the first material and at least some of the second material. The intermetal material has a thickness of from about 50 to about 150 Angstroms and consists of copper and palladium. The method includes removing any of the second metal-containing material that is not incorporated into the intermetal material. After the removing, the intermetal material is exposed to conditions effective to oxidize the first metal-containing material, but the intermetal material protects the first metal-containing material from oxidation. Applicant asserts that claim 79 is patentable over Chan, McTeer, and Takiar considered alone or in combination.

Pages 5-6 of the Office Action allege that Chan discloses many of the limitations that are now set forth in new claim 79, including the intermetal material, but acknowledges that Chan does not disclose the annealing temperature and the intermetal material thickness. The Office Action relies

upon McTeer as allegedly disclosing the claimed annealing and Takiar as allegedly disclosing the claimed intermetal material thickness.

Review of Chan reveals that it does not disclose or suggest any intermetal material, much less the claimed intermetal material consisting of copper and palladium. Throughout Chan, but in particular in column 4, lines 50-55, Chan consistently refers to alloy 61 as an alloy and does not provide any indication of an intermetal material. As may be appreciated at least from page 8, lines 6-15 of the present specification, a metal alloy is not necessarily an intermetallic material. Some alloys are not intermetals. The only reference throughout the entire text of Chan to an intermetallic material is the Inter-Metallic Dielectric (IMD) layer 64. However, layer 64 merely constitutes a dielectric "between" metal layers (i.e., "Inter-Metallic") instead of a type of metal alloy wherein the constituents are held together by metallic bonding (i.e., intermetallic). Accordingly, Chan cannot be considered to disclose or suggest the claimed intermetal material consisting of copper and palladium.

Applicant notes that at least column 4, lines 50-55 of Chan refer to a copper-palladium alloy, however, such disclosure does not inherently suggest a copper-palladium intermetal. The mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. Instead, some basis in fact and/or technical reasoning must reasonably support a determination that the allegedly inherent characteristic necessarily flows from the teachings of a prior art reference. Those of

ordinary skill recognize that the well-known phase diagram of a copper-palladium binary alloy system shows that solid phases of copper-palladium alloy primarily exist as a solid solution. Those of ordinary skill also recognize that a solid solution is not an intermetal material.

However, depending upon composition and temperature, it is possible for copper-palladium alloy to form intermetal materials. It follows that mere disclosure of copper-palladium alloy does not necessarily disclose copper-palladium intermetal material. This is especially true since column 4, lines 50-55 of Chan merely describe an annealing temperature of 200 to 400 °C. Claim 79 expressly sets forth annealing at greater than 400 to about 500 °C with the specific objective of forming an intermetal material. Accordingly, Chan cannot be considered to disclose expressly the claimed intermetal material consisting of copper and palladium, nor is such a material inherently disclosed in Chan. At least for such reasons, claim 79 is patentable.

The Office Action relies upon McTeer as allegedly disclosing the annealing temperature that is now set forth in claim 79. However, Applicant notes that the present application claims priority to an earlier application and that McTeer qualifies as prior art only under 35 U.S.C. 102(e). McTeer and the claimed invention were, at the time the claimed invention was made, owned by Micron Technology, Inc. or subject to an obligation of assignment to the same. Accordingly, McTeer cannot preclude patentability of claim 79.

Pages 5-6 of the Office Action allege that those of ordinary skill would be motivated to modify Chan with the teachings of McTeer by annealing Chan's alloy layer 61 at 440 to 480 °C to reduce reflectance or form an anti-reflective coating. Obviousness may be established by a combination of references, but not unless there is some motivation in the art to support the combination. Review of column 3, line 3 to column 4, line 5 of McTeer reveals that the relied upon annealing pertains only to titanium-aluminum compounds. While the McTeer annealing temperature may be sufficient to reduce reflectance or form an anti-reflective coating using titanium-aluminum compounds, no support exists for the proposition that the McTeer annealing would produce the same effect for Chan's alloy 61 containing copper and palladium. The copper palladium alloy 61 of Chan does not contain any elements in common with the McTeer titanium-aluminum metal stacks that are annealed. Those of ordinary skill do not have any expectation of success in reducing reflectance or forming an anti-reflective coating using the McTeer temperatures to process a completely different composition than disclosed in McTeer, i.e. copper palladium alloy 61 of Chan. Accordingly, the motivation alleged by the Office for combining McTeer and Chan is invalid. At least for such reasons, claim 79 is patentable.

Page 6 of the Office Action relies upon Takiar as allegedly disclosing the claimed intermetal material thickness of from about 50 to about 150 Angstroms. The Office Action acknowledges that Takiar does not explicitly

disclose the claimed composition, but alleges that discovery of optimal or workable ranges by routine experimentation is not inventive in the absence of unexpected results. However, the Office Action relies upon legal grounds that do not apply in the current circumstances.

Claim 79 sets forth a thickness of 50-150 Angstroms for an intermetal material consisting of copper and palladium. By comparison, Takiar allegedly sets forth a thickness of 80-300 Angstroms for a layer containing palladium. Accordingly, the deficiency in Takiar is not that it discloses a different thickness range, instead, Takiar discloses a different composition. It is thus irrelevant whether or not a thickness of 50-150 Angstroms of palladium may be discovered by routine experimentation since Takiar fails to disclose or suggest that its 800-300 Angstrom thickness applies to the claimed intermetal material consisting of copper and palladium. None of the cited references disclose or suggest a thickness for intermetal material consisting of copper and palladium. A combination of references cannot be considered to disclose or suggest subject matter that is absent from all references.

To the extent that the Office proposes replacing Chan's alloy 61 containing copper-palladium with Takiar's palladium layer 30 having a thickness of 80-300, Applicant asserts that no suggestion or motivation exists in the art for such a substitution. Fig. 2G of Chan and the accompanying text in column 4, lines 56-60 expressly describe removing any palladium, leaving behind alloy 61 containing copper-palladium.

Accordingly, substitution of Chan's alloy layer 61 for Takiar's palladium layer 30 would result in removal of palladium layer 30 during the selective etching shown in Fig. 2G. Accordingly, the proposed substitution would render the Chan process inoperable for its intended purpose. At least for such reason, no suggestion or motivation can be considered to exist to make the proposed modification. At least for such reasons, claim 79 is patentable.

In summary, Applicant asserts that none of the cited references, in including Chan, disclose or suggest the claimed intermetal material consisting of copper and palladium. Also, none of the cited references, including McTeer, disclose or suggest annealing the claimed first and second metal-containing materials at a temperature of greater than 400 to about 500 °C to form an intermetal material. Further, none of the cited references, including Takiar, disclose or suggest an intermetal material consisting of copper and palladium having thickness of from about 50-150 Angstroms. At least for such reasons, Applicant asserts that the cited references considered alone or in combination fail to disclose or suggest every limitation of claim 79.

Claims 55-56 and 58-61 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chan (U.S. 6,100,195) in view of Takiar (UK 2184288). Applicant requests reconsideration.

Claim 55 sets forth a conductive connection forming method that includes, among other features, forming an intermetallic layer containing palladium and copper and having a thickness of from about 50 to about 150

Angstroms, exposing the intermetallic layer, and forming a conductive connection directly to the intermetallic layer without a passivation layer there between. As may be appreciated from the discussion above regarding the deficiencies of Chan and Takiar as applied to claim 79, neither reference discloses or suggests the claimed intermetallic layer containing palladium and copper. Also, neither reference discloses or suggests such an intermetallic layer having thickness of from about 50 to about 150 Angstroms. At least for such reasons, claim 55 is patentable. Claims 56 and 58-61 depend from claim 55 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

Claim 57 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Chan in view of Takiar as applied to claim 55 above, and further in view of McTeer. Applicant requests reconsideration. Claim 57 sets forth annealing at a temperature greater than 400 to about 500 °C. As may be appreciated from the above discussion regarding the deficiencies of McTeer as applied to claim 79, none of the cited references disclose or suggest the claimed annealing. Claim 57 is thus patentable.

Claims 62-63 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chan in view of McTeer and Takiar. Applicant requests reconsideration.

Claim 62 sets forth an oxidation protection method that includes, among other features, annealing at a temperature of greater than 400 to

about 500 °C to form an intermetal material having a thickness of from about 50 to 150 Angstroms and exposing the intermetal material to conditions effective to oxidize a first metal-containing material, but the intermetal material protecting at least some of the first metal-containing material. As may be appreciated from the discussion above regarding the deficiencies of the cited references as applied to claim 79, none of the cited references disclose the claimed annealing to form an intermetal material. Also, none of the cited references disclose the claimed intermetal material thickness. At least for such reasons, claim 62 is patentable over the cited references. Claim 63 depends from claim 62 and is patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested. For example, claim 63 sets forth that the intermetal material consists of copper and palladium. None of the cited references disclose or suggest such an intermetal material composition.

Claims 64-68 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al in view of McTeer. Applicant requests reconsideration.

Claim 64 sets forth an integrated circuit via forming method that includes, among other features, forming an intermetallic material containing copper and palladium at least partially within a first wiring level at a temperature of greater than 400 to about 500 °C and forming a conductive via on and in electrical contact with the intermetallic material. As may be appreciated from the discussion above regarding the deficiencies of the

cited references as applied to claim 79, none of the cited references disclose or suggest the claimed intermetallic material. Also, none of the cited references disclose or suggest the claimed process temperature. At least for such reasons, claim 64 is patentable. Claims 65-68 depend from claim 64 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

Applicant herein establishes adequate reasons supporting patentability of claims 55-68 and 79 and requests allowance of all pending claims in the next Office Action.

Respectfully submitted,

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